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EFFECT OF ORGANIC-CUM-INORGANIC SOURCES OF NUTRIENTS ON GROWTH, YIELD AND ECONOMICAL GAIN FROM GUAVA

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ABSTRACT

A field experiment find out result during 2015 and 2016 to study the organic-cum-inorganic sources of nutrient management (INM) on growth, yield and economical gain from 6 years old guava trees. Application of 100% NPK with Zn, B, Mn micronutrients and organic mulch (T_4) resulted in maximum plant height (4.07 m), circumference of root stock (38.51 m) and of scion (36.57 m), plant spread E-W and N-S (3.79 to 3.80 m), leaf length (17.98 cm) and width (8.94 cm), tree volume (184 m^3), fruits (297/tree), fruit weight (220.8 g), fruit yield (65.58 kg/tree and 181.64 q/ha) as well as net income (Rs.167270/ha) and B:C ratio upto 3.96.

KEYWORDS: Organic-Cum, Plant Spread E-W & B:C ratio Upto 3.96

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Original Article

INTRODUCTION

Guava (*Psidium guajava* L.) belongs to the family Myrtaceae. Guava is known as the "apple of the tropics" or "poor man's fruit". Guava is one of the most promising fruit crops of India and is considered to be one of the exquisite nutritionally valuable and remunerative crops (Singh *et al.*, 2000). At present in India, it occupies nearly 0.204 million hectares area with a production of 2.46 million tonnes and productivity 11. 12 million tonnes/hectare and in Madhya Pradesh 2763 hectares area with a production of 55260 tonnes and productivity 20.0 tonnes/hectare (NBH, 2011). In Rewa region, guava is grown on an area of 277 ha with a production of 2019 tonnes and productivity of 7.29 t/ha, which is very low as compared to national average. The stagnation and decline in the productivity of guava in Rewa region is due to decline in the soil organic matter, over mining of nutrients reserve, loss of nutrients and non-availability of cost effective fertilizers.

Integrated nutrient management has been considered as the essential component of sustainable crop production system. Keeping in view the increasing gap between removal and supply of essential plant nutrients, search for alternative plant nutrients sources has gained momentum (Amer *et al.*, 2014). The application of fertilizers even in balanced form may not sustain the soil fertility and productivity in guava orchards. However, research evidences are encourageous about the integrated use of inorganic fertilizers, bio fertilizers and organic manures including crop residues, vermi compost which may improve the soil productivity and crop yield (Singh *et al.*, 2011). Vermi compost contains plant growth regulating materials, such as humic acids and plant growth regulators like auxins, gibberellins and cytokinins (Borang *et al.*, 2016), which are responsible for increased plant

growth and yield of strawberry fruit crops. Bio fertilizers are one of the best modern tools for agriculture and are used to improve the fertility and quality of the soil. It offers an economically attractive and ecologically sound route for augmenting nutrient supply that enables to plant growth and development of fruit crops (Joseph *et al.*, 2015). Such information for guava was lacking for Rewa region, hence the present work was taken up.

MATERIALS AND METHODS

The present experiment finds out result during 2015 and 2016. The soil of the guava orchard was mixed red-black with clay-loam in texture having soil pH 7.23 to 7.29, available-N 289 to 341 kg/ha, available P_2O_5 14.33 to 26.88 and available K_2O 266 to 288 kg/ha. The experiment consisted of 15 treatments (Table 1) keeping three plants of 6 years old in each treatment. The treatments were arranged in a randomized block design and replicated thrice. The guava variety Allahabad Safeda was taken as the test variety. The entire dose of 25 kg FYM and 5 kg vermi compost/tree was applied as basal dose on the onset of monsoon. The required quantity of NPK fertilizers (25, 50 and 100% per tree) were applied in two splits in July and August. The bio fertilizers were applied one week after each application of NPK fertilizers. Micronutrients (Zn, B and Mn) were foliar sprayed twice in August and October. The periodical observations were recorded on growth and yield parameters including estimation of economics per hectare under each treatment.

RESULTS AND DISCUSSIONS

Vegetative Growth Parameters

The vegetative growth characters of 6 years old Allahabad Safeda trees have been evaluated after applying IPNM treatments by recording the observations on plant height, canopy height, circumference of rootstock, plant spread (E-W and N-S), leaf length and width, fresh and dry weight of leaf and volume per tree. These vegetative growth parameters i.e. plant height, canopy height, plant girth and leaf were influenced upto significant extent due to treatments. The treatments T_4, T_{10} and T_{15}, resulted in equally maximum increase in the plant and canopy height, girth, plant spread in both the directions (N-S and E-W) as well as leaves observations and volume of tree over control and other treatments (Table 1). The second, third and fourth best treatments were T_{15}, T_9, and T_{10}, respectively. The most beneficial effect of these IPNM treatments might be due to plant growth promoting applied inputs like organic manures, organic mulching and bio fertilizers as well as improvement in the physical, chemical and biological properties of the soil in the long-term on repeated applications. It might have also stimulated micro-biological activities in the soil.

In fact, leaf is the factory for the conversion of solar energy into the chemical energy by the process of photosynthesis. The adequate supply of multi nutrients resulted in their proper utilization in the process of photosynthesis due to increase in the leaf number and leaf size i.e. photosynthetic area. Thus, the increased production of photo synthates (food material) brought about increase in the vegetative growth parameters. Leaf is the principal site of plant metabolism and the changes in nutrients supply are reflected in the composition of leaf.

The present findings corroborate with those of Athani *et al.* (2007), Naik and Babu (2007), Ram *et al.* (2007) who found that vermicompost with FYM and inorganic fertilizers resulted increase in the vegetative growth. Similar findings have been reported by Monga *et al.* (2002), Ram *et al.* (2005), Khan *et al.* (2007), Ram and Pathak (2007), Kumar *et al.* (2007), Dutta *et al.* (2009), Patel *et al.* (2009), Shukla *et al.* (2009), Dwivedi (2013), Agnihotri *et al.* (2013), Amer *et al.* (2014), Beer and Singh (2015) and Singh *et al.* (2015).

Productivity Parameters

The number of fruits/tree and fruit weight as well as the yield of fruits per tree and per hectare were increased equally maximum in T_4 (100% NPK + micronutrients + organic mulching), followed by T_{10} (50% NPK + 25 kg FYM + 250 g *Trichoderma* + 250 g *Pseudomonas*) and T_{15} (50% NPK + 25 kg FYM + 5 kg vermicompost). The maximum increase in yield parameters might be attributed to better nutritional environment due to application of organic matter which improved the soil health by improving physico-chemical and biological activities of the soil and also stimulated soil microbiological activity. Athani *et al.* (2007 a, b) reported that application of 75% RDF + 10 kg vermicompost was found significant increase in yield and fruit quality of guava cv. Sardar.. Ram *et al.* (2007) reported that the application of different fertilizers, organic manures and biofertilizers improved the vegetative growth, number of fruits and yield of guava cv. Sardar. Similar findings have been found by Ram and Pathak (2007), Naik and Babu (2007), Ram *et al.* (2007), Kumar *et al.* (2009), Dutta *et al.* (2009), Patel *et al.* (2009), Shukla *et al.* (2009), Agnihorti *et al.* (2013), Dwivedi (2013), Bohane and Tiwari (2014), Joseph *etal.* (2015), Pongener and Alila (2015) and Singh *et al.* (2015)..

Mulching is very beneficial. It reduces the loss of moisture from the soil, enhances the rate of penetration of run of water and controls the growth of weeds, thus eliminating the competition between the weeds and the guava trees. It also encourages the development of better root system of young guava plants. Verma *et al.* (2005) found the good response of mulching materials and method of P and K fertilizers application in apple cv. Red Delicious.

Application of integrated inputs of fertilizers, organic manures and biofertilizers as in T_7 to T_{15} also increased the yield in guava cv. Allahabad Safeda. It may be due to increased rhizosphere microbial activity and larger quantity of nutrients in the soil. Ram *et al.* (2007) found that application of different fertilizers, organic manures and biofertilizers improved the vegetative growth, number of fruits and yield of guava cv. Sardar. The similar findings were found by Monga *et al.* (2002), Mitra *et al.* (2007), Agnihotri *et al.* (2013) and Dwivedi (2013), Amer *et al.*(2014), Bohane and Tiwari (2014), Singh *et al.* (2015), Joseph *et al.* (2015), Singh *et al.* (2015), Pongener and Alila (2015) and Beer and Singh (2015).

Fruit Yield and Economical Gain

Yield attributes and therefore economics of different treatments were significantly influenced by the application of organic manures, inorganic fertilizes, bio fertilizers and their combinations. The treatment T_4 gave the highest yield (181.64 q/ha), followed by T_{10} (174.40 q), T_{15} (172.93 q) and T_{14} (165.42 q/ha), whereas the lowest yield was obtained under T_1 (98.85 q/ha). Eventually the similar trend was also observed regarding the economics of different treatments. The maximum net profit per hectare was obtained from T_4 (Rs. 387520/ha), followed by T_{10} (Rs.362320/ha) and then T_{15} and T_{14} (Rs.360270 and Rs.341530/ha, respectively), while it was minimum under T_1 control (Rs.186270/ha). Benefit: cost ratios were also in the higher range in these treatments. The higher income was due to higher fruit yield in these treatments. Shukla *et al.* (2009) observed that the combined application of 50 per cent dose of recommended NPK + 50 kg FYM + 250 g *Azotobactor* gave significantly higher yield28.95 kg per plant with higher B:C ratio 2.53. Similar findings have been reported by Dutta and Banik (2002), Dey *et al.* (2005), Athani *et al.* (2007), Dwivedi *et al.* (2010), Binepal *et al.* (2013), Dwivedi (2013), Bohane nd Tiwari (2014) and Beer and Singh (2015).

CONCLUSIONS

In this over all study economical gain from guava as a sources of nutrients we have found ,the treatment of T4 gave the highest yield (181.64 q/ha), followed by T10 (174.40 q), T15 (172.93 q) and T14 (165.42 q/ha), whereas the

lowest yield was obtained under T1 (98.85 q/ha). The maximum net profit per hectare was obtained from T4 (Rs. 387520/ha), followed by T10 (Rs.362320/ha) and then T15 and T14 (Rs.360270 and Rs.341530/ha, respectively. Application of integrated inputs of fertilizers, organic manures and bio-fertilizers as in T7 to T15 also increased the yield in guava There are also found similarity between previous literatures. So we can say that we are on the wright path to gain economic benefits from natural products buy artificial methods.

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Table 1: Vegetative Growth of Guava Fruits cv. Allahabad Safeda as Influenced by Integrated Nutrient Management (Mean of Two Years)

S. No.	Treatments	Plant Height (m)	Circum-ference of Root-Stock (m)	Circum-ference of Scion (m)	Plant Spread E-W (m)	Plant Spread N-S (m)	Leaf Length (cm)	Leaf Width (cm)	Tree Volume (m^3)	Fruits/ Tree	Fruit Weight (g)	Fruit Yield (kg/Tree)	Fruit Yield (q/ha)	Net Income (Rs.ha)	B:C ratio
T_1	500 g : 200 g : 500 g NPK/tree (as control)	3.73	36.87	34.18	3.09	3.11	16.44	7.04	111.47	221.01	161.50	35.69	98.85	135270	3.65
T_2	T_1 + Zn (0.5%) + B (0.2%) + Mn (1%) as foliar spray twice (August and October)	3.81	37.18	35.71	3.30	3.35	17.03	7.41	131.79	228.28	165.65	37.81	104.73	144270	3.72
T_3	T_2 + organic mulching @ 10 cm thick	3.85	37.29	35.80	3.43	3.41	17.72	7.73	144.82	239.81	181.50	43.53	120.58	160770	3.95
T_4	T_2 + organic mulching @ 10 cm thick	4.07	38.51	36.57	3.80	3.79	17.98	8.94	184.09	296.93	220.85	65.58	181.64	167270	3.96
T_5	25% recommended dose of fertilizer + 25 kg FYM + 250 g *Aspergillus niger*	3.94	37.08	35.08	3.54	3.58	16.94	7.30	156.27	251.33	202.05	50.79	140.67	134520	3.19
T_6	25% recommended dose of fertilizer + 25 kg FYM + 125 g *Aspergillus niger*	3.95	36.91	35.93	3.41	3.39	17.83	7.68	144.23	270.34	190.00	51.36	142.27	149720	3.44
T_7	25% recommended dose of fertilizer + 25 kg FYM + 125 g *Trichoderma*	3.92	37.94	35.01	3.52	3.61	16.52	7.91	155.72	253.11	175.25	44.36	122.86	149670	3.45
T_8	25% recommended dose of fertilizer + 25 kg FYM + 125 g *Trichoderma* + 125 g *Pseudomonas*	3.88	38.10	35.75	3.56	3.64	17.02	7.21	157.71	279.43	168.80	47.17	130.64	143970	3.35
T_9	50% recommended dose of fertilizer + 25 kg FYM + 250 g *Pseudomonas florescence*	3.85	38.05	35.79	3.61	3.64	17.31	7.45	132.26	285.55	169.85	48.51	134.37	156070	3.45
T_{10}	50% recommended dose of fertilizer + 25 kg FYM + 250 g *Trichoderma* + 250 g *Pseudomonas*	4.03	38.43	36.47	3.67	3.75	17.85	8.80	173.86	295.02	213.40	62.96	174.40	155070	3.44
T_{11}	50% recommended dose of fertilizer + 25 kg FYM + 250 g *Aspergillus niger*	3.90	36.97	35.75	3.59	3.56	17.20	7.54	156.21	258.48	174.65	45.15	125.06	152070	3.41
T_{12}	50% recommended dose of fertilizer + 25 kg FYM + 250 g *Trichoderma*	3.85	37.96	35.95	3.61	3.58	17.39	7.07	148.71	273.78	176.05	48.21	133.52	148420	3.40
T_{13}	50% recommended dose of fertilizer + 25 kg FYM + 250 g *Azospirillum*	3.94	37.83	36.08	3.59	3.59	17.32	7.10	159.15	277.40	179.30	49.75	137.81	151030	3.44
T_{14}	50% recommended dose of fertilizer + 25 kg FYM + 250 g *Azotobacter*	3.89	37.92	36.28	3.62	3.64	17.41	7.44	150.64	292.23	204.35	59.72	165.42	150030	3.42
T_{15}	50% recommended dose of fertilizer + 25 kg FYM + 5 kg vermicompost	4.02	38.19	36.40	3.63	3.71	17.74	8.72	169.20	294.61	211.90	62.43	172.93	159270	3.57
	S.Em+	**0.003**	**0.022**	**0.024**	**0.007**	**0.007**	**0.018**	**0.024**	**0.705**	**0.929**	**0.725**	**0.336**	**0.006**	--	--
	C.D. at 5%	**0.016**	**0.100**	**0.110**	**0.030**	**0.031**	**0.082**	**0.112**	**3.305**	**4.355**	**3.400**	**1.576**	**0.029**	--	--